

OPD 5462-59

10 August 1959

MEMORANDUM FOR THE RECORD

SUBJECT: Trip Report -

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1. The feasibility of utilization of the APG-53A radar in the program and for air drops was investigated at the Naval Ordnance Test Station, China Lake, California. The capabilities, growth, and limitations were discussed with the Radar Project pilots and maintenance personnel. Two flights were made in an F3D equipped with subject gear.

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2. The Radar Set AN/APG-53A is a subminiature radar set offering automatic air-to-ground range tracking, terrain clearance, and limited mapping capabilities. The radar was designed primarily for use in aircraft of the A4D class, an aircraft class which demands an extremely versatile radar and imposes very stringent size and weight limitations upon the system. This radar system, now in the pilot production stage, utilizes monopulse r-f transmission techniques in all modes coupled with straightforward computer mechanization approaches, with the system having a total weight of approximately 75 pounds.

3. The present AN/APG-53A offers the pilot a choice of the following fully automatic modes:

a. Air-to-Ground Ranging: providing an accurate measurement of the slant range to the ground along the antenna boresight line, no discrete radar targets being required on the ground.

b. Limited Mapping: offering a "B scope" presentation with a forty-mile maximum range for use in the identification of coastlines and other prominent radar targets.

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c. Vertical (Profile) Terrain Clearance, displaying on an "E scope" accurate information regarding the profile of the terrain lying ahead of the aircraft for use in letting down through an overcast and as an aid in foul-weather navigation.

d. Obstacle Alarm, monitoring the terrain clearance displays and alerting the pilot whenever terrain lying ahead of the aircraft protrudes above an imaginary horizontal plane positioned below the aircraft, and

e. Horizontal Terrain Clearance, displaying on a "B scope" presentation all obstacles within a sixty degree sector ahead of the aircraft and extending to the aircraft altitude.

3. This system offers carrier based naval aircraft the capability of making a radar identified "land-fall", followed by the identification of prominent radar targets, the ability to let down safely through an overcast over unknown terrain, and finally, the ability to deliver special weapons by a loft maneuver without the necessity for the use of an initial point (I.P.).

4. System Characteristics - The radar circuits have been designed to provide the following system characteristics:

a. Transmitter:

| | |
|----------------------------|----------------------------|
| Frequency | 9375 - 30 megacycles |
| Power output | 3 kilowatts peak (minimum) |
| Pulse width | 0.35 microsecond |
| Pulse repetition frequency | 3000 and 1500 cps |

b. Range:

| | |
|---------------|----------------------|
| Air-to-ground | 15,000 yards maximum |
| Range slope | 10 mv/yd slant range |

c. Terrain Clearance Capabilities:

(1) Limited Mapping

| | |
|------------------|------------------------------|
| Range | 0 to 20, 0 to 40 miles |
| Azimuth coverage | ± 30° (60° sector) |
| Presentation | "B" scope (range vs azimuth) |

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(2) Vertical Terrain Clearance

| | |
|--------------------|--|
| Ranges | 0 to 10, 0 to 20 miles |
| Elevation coverage | +10 to -15° from aircraft flight path |
| Presentation | "E" scope (range vs antenna depression angle) |

(3) Horizontal terrain clearance

| | |
|--------------------|------------------------------|
| Ranges | 0 to 10, 0 to 20 miles |
| Azimuth coverage | ± 30° (60° sector) |
| Elevation coverage | +10 to -15° (adjustable) |
| Presentation | "B" scope (range vs azimuth) |

(4) Obstacle alarm: Pilot warning of obstacles protruding above a horizontal plan positioned 1,000 feet below the aircraft in mode (2) above

d. **Tracking technique:** Gated i-f receiver, single gate tracking, velocity and position memory.

e. **Accuracy:** ± 25 yards or 2% of actual range (whichever is greater).

f. **Antenna dish size:** 15 7/8-inch parabolic reflector.

g. **System weight:** 56 pounds (AN/APG-53) and 80 pounds (AN/APG-53A).

5. **Tuning Band Range and Sensitivity.** The radar receivers are fixed frequency receivers, tuned to 9375 megacycles with a minimum sensitivity of 65 dbm, and an over-all noise figure of less than 15.

6. **Power Requirements.** The power supply requires three phase, 115 volt line-to-neutral, ABC phase rotation, wye connected, 400-cycle, a-c power at 2 amperes per phase and in turn supplies the following power to the system:

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| | <u>AN/APG-53</u> | <u>AN/APG-53A</u> |
|--------------------------------|------------------|-------------------|
| a. +250 d-c at | 50 ma | 35 ma |
| b. -250 d-c at | 75 ma | 105 ma |
| c. +130 d-c at | 330 ma | 520 ma |
| d. +27.0 d-c at | 525 ma | 1.2 amp |
| e. -600 d-c at | --- | 7.7 ma |
| f. +6.3 d-c at | --- | 1.25 amp |
| g. 6.3 a-c at (at -600 d-c) | --- | 6.3 amp |

7. The radar size is conducive to being placed in a pod for attachment on a wing. Certain modifications of performance would probably be necessary to obtain maximum utilization, i.e., stabilization of radar for pitch and roll, manual override of terrain clearance mode to allow a sweep of either side of present 5° forward track, and possible inclusion of doppler for accurate DR navigation. A doppler for inclusion within this radar system is in the final test stage. The expected accuracy will be 1° of track.

8. The APG-53A radar appears to be capable of adding to effectiveness to fire air drop missions and survival of the [redacted] flights. It is recommended that two be procured for further exploitation.

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SIGNED

[redacted]
Lcdr, USN

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- 1 - AC-DPD
- 1 - Ch, Ops Br, DPD
- 1 - Ch, R&D
- 1 - Ch, Air Section
- 1 - Ch, Mat Br
- 1 - Ch, Commo Section
- 1 - TSS (hold)
- 1 - Intel
- 1 - Ops chron
- 1 - RI

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